AGA KHAN UNIVERSITY EXAMINATION BOARD

HIGHER SECONDARY SCHOOL CERTIFICATE

CLASS XI EXAMINATION

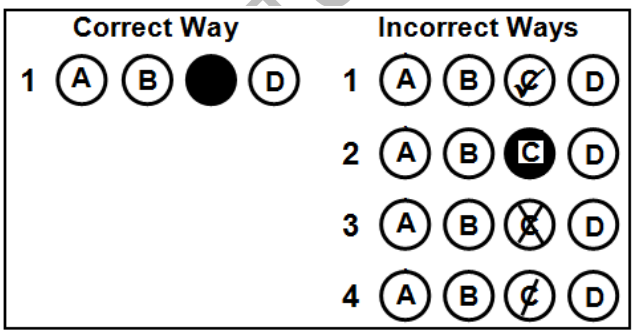
APRIL/ MAY 2019

Mathematics Paper I

Time: 60 minutes Marks: 40

INSTRUCTIONS

1. Read each question carefully.
2. Answer the questions on the separate answer sheet provided. DO NOT write your answers on the question paper.
3. There are 100 answer numbers on the answer sheet. Use answer numbers 1 to 40 only.
4. In each question, there are four choices A, B, C, D. Choose ONE. On the answer grid, black out the circle for your choice with a pencil as shown below.



Candidate's Signature

5. If you want to change your answer, ERASE the first answer completely with a rubber, before blacking out a new circle.
6. DO NOT write anything in the answer grid. The computer only records what is in the circles.
7. You may use a scientific calculator if you wish.

1. $(1-2i)\times(1+2i)$ is equal to

   A. -3
   B. 5
   C. $1-4i$
   D. $1+4i$

2. When the conjugate of a complex number p is expressed as $-i+ci^2$, then p is

   A. $-i-c$
   B. $-i+c$
   C. $i-c$
   D. $i+c$

3. If $iv=\frac{9}{i}$, then the modulus of $-v$ is equal to

   A. -9
   B. -3
   C. 3
   D. 9

4. The imaginary part of v, where $v=\left(\frac{i}{a}\right)^{-1}$, is equal to

   A. $-\frac{1}{a}$
   B. $-a$
   C. a
   D. $\frac{1}{a}$

5. Which of the following option(s) is CORRECT for the matrix $N=\begin{bmatrix}1&0&0\\0&1&0\\0&0&1\end{bmatrix}$?

   I. N is a null matrix.
   II. N is a square matrix.
   III. N is a diagonal matrix.

   A. I only
   B. II only
   C. I and III
   D. II and III

6. For the matrix $\begin{bmatrix} m & ? \\ 0 & n \end{bmatrix}$, where $m>0$ and $n<0$, the determinant

A. is zero.
B. is positive.
C. is negative.
D. cannot be determined.

7. If $N-M$ is a skew symmetric matrix, then we have

A. $(M-N)^t$
B. $(N-M)^t$
C. $N-M$
D. $M-N$

8. The determinant $\begin{vmatrix} m_{11} & m_{12} \\ m_{21} & m_{22} \end{vmatrix}$ can also be written in another form as

(**Note:** k is a constant.)

A. $\begin{vmatrix} m_{11}+k & m_{12} \\ m_{21}+k & m_{22} \end{vmatrix}$

B. $\begin{vmatrix} m_{11}\times k\, m_{12} & m_{12} \\ m_{21}\times k\, m_{11} & m_{22} \end{vmatrix}$

C. $\begin{vmatrix} m_{11} & m_{12}-k\, m_{11} \\ m_{21} & m_{22}-k\, m_{21} \end{vmatrix}$

D. $\begin{vmatrix} m_{11}\div k\, m_{21} & m_{12} \\ m_{21}\div k\, m_{11} & m_{22} \end{vmatrix}$

9. If the transpose of matrix M is $[-1-m \quad 2+n \quad 5^2 \quad -3]$, then M would be

A. $-\begin{bmatrix} 1+m \\ -2-n \\ -25 \\ 3 \end{bmatrix}$

B. $\begin{bmatrix} -1-m \\ 2n \\ 10 \\ -3 \end{bmatrix}$

C. $\begin{bmatrix} -1-m \\ 2n \\ 25 \\ -3 \end{bmatrix}$

D. $-\begin{bmatrix} 1+m \\ n-2 \\ 10 \\ -3 \end{bmatrix}$

10. The product of $[-1 \quad i]$ and $\begin{bmatrix} \sqrt{-1} \\ 1 \end{bmatrix}$ is equal to

A. $[0]$
B. $[-2]$
C. $[-1+i]$
D. $[-i \quad i]$

11. The general term of the sequence $a^2, -a^3, a^4, -a^5, \ldots$ is

A. $-\dfrac{a^n}{a}$
B. $\dfrac{(-a)^n}{a}$
C. $-a^{n+1}$
D. $(-a)^{n+1}$

12. If $T_n - a = 8d$, then the number of terms n in this arithmetic progression will be

(**Note**: Symbols have their usual meanings.)

A. 9
B. 8
C. 7
D. 2

13. The half of arithmetic mean between two numbers $\sqrt{2a}$ and $\sqrt{b-a}$ is

A. $\frac{\sqrt{2a}+\sqrt{b-a}}{2}$
B. $\frac{\sqrt{2a}+\sqrt{b-a}}{4}$
C. $\frac{\sqrt{a+b}}{4}$
D. $\frac{\sqrt{a+b}}{2}$

14. For a geometric sequence, if $(r-1) = ka$, where k is a constant, then $k S_\infty$ will be

(**Note**: Symbols have their usual meanings.)

A. -1
B. $k-\frac{1}{k}$
C. $k+\frac{1}{k}$
D. 1

15. If three geometric means are inserted between a and b to obtain a geometric progression, then b is the

A. 2nd term.
B. 3rd term.
C. 4th term.
D. 5th term.

16. If $\sum_{k=1}^{2} k = 3$, then the value of $\sum_{k=3}^{n} k$ is equal to

(**Formula**: $\sum_{k=1}^{n} k = \frac{n(n+1)}{2}$)

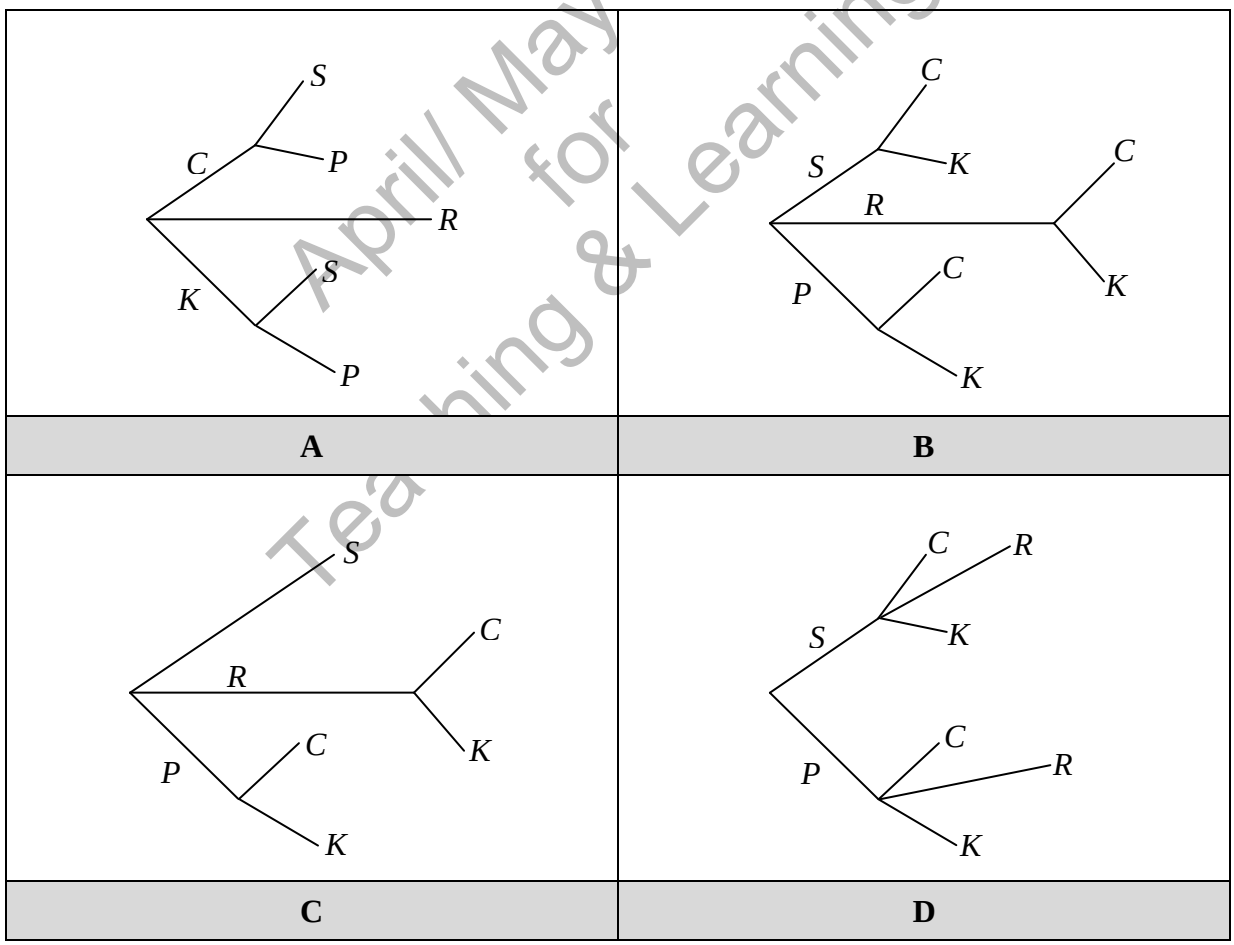
A. $\frac{n(n+1)}{2} - 3$

B. $n\left(n+\frac{1}{2}\right)-3$

C. $3 - \frac{n(n+1)}{2}$

D. $3 - n\left(n+\frac{1}{2}\right)$

17. A man goes to a bakery where he finds *Samosa* (*S*), Vegetable rolls (*R*) and Potato Cutlets (*P*). They are served with *Chatni* (*C*) or *Ketchup* (*K*). The tree diagram which illustrates the given situation for all possible combinations will be



18. On evaluating, the combination $\begin{pmatrix} a-b \\ a-b-1 \end{pmatrix}$ reduces to

A. 1
B. $a-b$
C. $(a-b)!$
D. $(a-b-1)!$

19. If $(3-x)! = 24$, then the value of x is equal to

A. – 21
B. – 19
C. – 18
D. – 1

20. The three events K, L and M are defined as:

$K = \{x : x+1=0\}$, $L = \{-1, 1\}$ and $M = \{0,1\}$

Which of the given events are mutually exclusive?

A. K and M
B. L and M
C. K and L
D. L and L

21. By principle of mathematical induction, to prove that $1^3 + 2^3 + 3^3 + ... + K^3 = \frac{K^2(K+1)^2}{4}$ is true for $(K+1)^{th}$ term, the term that should be added to both sides is

A. $\frac{(K+1)^3(K+2)^3}{4}$
B. $\frac{(K+1)^2(K+2)^2}{4}$
C. $(K+1)^3$
D. K^3+1

22. The required condition to obtain the constant term in the expansion of $\left(x^2 + \frac{1}{x}\right)^6$ will be

(**Formula**: $T_{r+1} = {}^nC_r a^{n-r} b^r$, where, symbols have their usual meanings.)

A. $12-r=r$
B. $12-2r=r$
C. $12+r=-r$
D. $12+2r=-r$

23. On expanding $(y+x)^m$, the binomial coefficients of third and fourth terms become equal. The total number of terms in this expansion

A. is 5
B. is 6
C. is m
D. cannot be determined.

24. The equation $2x^{-1}+5=7x^{-2}$ can be reduced to quadratic form $7t^2-2t-5=0$ by using the substitution(s)

I. $x=\frac{1}{t}$
II. $x=t$
III. $\frac{1}{x}=t$

A. I only.
B. II only.
C. I and III.
D. II and III.

25. The roots of a quadratic equation are $x=\frac{-12\pm\sqrt{144-4(?)(m)}}{-18}$.

To make the given roots complex, the required condition will be

A. $m<4$
B. $m>4$
C. $m<-4$
D. $m>-4$

26. If ω is one of the complex cube roots of unity, then $(1+\omega^2)^2$ is equal to

A. ω^2
B. $-\omega^2$
C. -1
D. 1

27. In fourth roots of unity, the product of real roots is *m* and the product of imaginary roots is *n*.

The value of $m-n$ is equal to

A. 0
B. 2
C. -2
D. -1

28. If α and β are the roots of $ax^2 - bx = 1$, then the value of $(\alpha-\beta)^2 - (\alpha+\beta)^2$ will be

A. $-\frac{1}{a}$
B. $\frac{1}{a}$
C. $-4\left(\frac{1}{a}\right)$
D. $4\left(\frac{1}{a}\right)$

29. When a polynomial $P(x)$ of degree 4 is divided by $x-3$, the remainder is -11 as shown in the given synthetic division.

3	1	0	-10	-2	4
		3	9	-3	-15
	?	?	-1	-5	-11

The quotient of the polynomial for the given solution is

A. $-x-5$
B. $-x^2-5x$
C. x^3+3x^2-x-5
D. $x^4+3x^3-x^2-5x$

30. The positive square root of $\left[4\left(1+\frac{1}{\tan^2\beta}\right)\right]$ will be equal to

A. $2\cot\beta$
B. $2\tan\beta$
C. $2\sec\beta$
D. $2\operatorname{cosec}\beta$

31. The square of the distance between two points $(-s_m, 0)$ and $(0, -t_n)$ will be

A. $(s_m)^2 - (t_n)^2$
B. $(s_m)^2 + (t_n)^2$
C. $(s_m - t_n)^2$
D. $(s_m + t_n)^2$

32. The trigonometric ratio $\sin[2(A-B)]$ can be expressed as

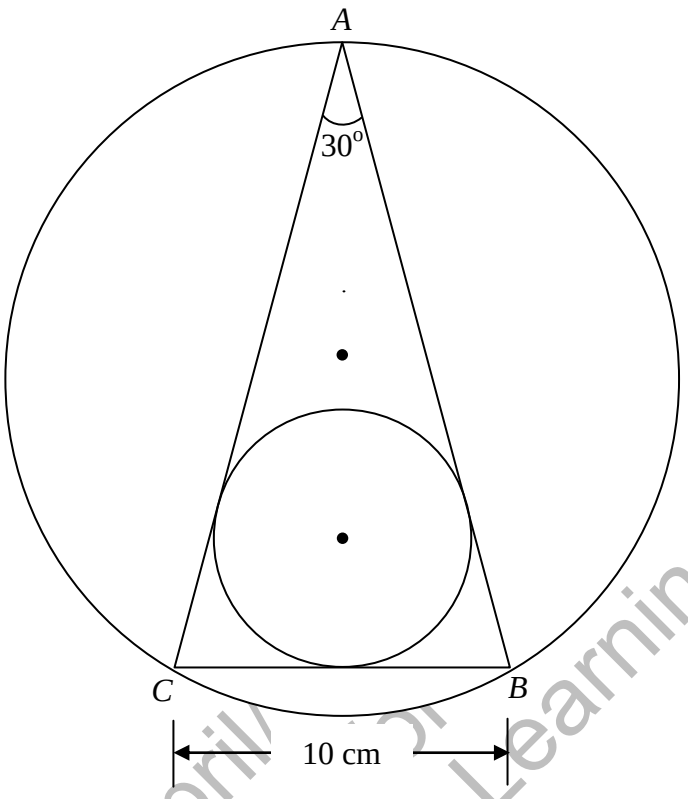
A. $-2\sin A\cos B$
B. $2\sin A - 2\cos B$
C. $2\sin(A-B)\cos(A-B)$
D. $-2\sin(A-B)\cos(A-B)$

33. 3π radians can be expressed in degrees as

A. 0.16°
B. 9.42°
C. 180°
D. 540°

Use the given information to answer Q.34, Q.35 and Q.36.

A circum-circle and in-circle are drawn with different centres as shown in the given diagram. The triangle *ABC* is an isosceles triangle with $BC = 10$ cm and $\angle A = 30^{o}$.



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34. The value of twice of circum-radius is equal to

A. 5
B. 20
C. 25
D. 40

35. The area of triangle *ABC* is equal to

A. $50 \times \sin 30^{o}$
B. $100 \times \sin 30^{o}$
C. $100 \times \left(\sin 75^{o}\right)^{2}$
D. $200 \times \left(\sin 75^{o}\right)^{2}$

36. If $AB = x$, then the expression for $\dfrac{\text{area of triangle } ABC}{\text{radius of inscribed circle}}$ will be

A. $x + 5$
B. $x + 10$
C. $2x + 5$
D. $2x + 10$

37. If $\sin(2\pi + m\alpha) = \sin[(k-1)\alpha]$, then the value of $(k-1)$ will be

A. 3
B. m
C. $2m\pi$
D. $2\pi + m$

38. The maximum value of $\frac{-1}{5+2\sin(2m+\beta)}$ is equal to

A. $-\frac{1}{3}$
B. $-\frac{1}{7}$
C. $\frac{1}{7}$
D. $\frac{1}{3}$

39. The period of $\tan\frac{x}{2}$ is

A. $\frac{\pi}{2}$
B. π
C. $\frac{3\pi}{4}$
D. 2π

40. The range of $y = \sin\frac{\theta}{4}$ is

A. $-\frac{1}{4} \le y \le \frac{1}{4}$
B. $-\frac{1}{2} \le y \le \frac{1}{2}$
C. $-1 \le y \le 1$
D. $-2 \le y \le 2$

END OF PAPER

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